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[MTD 26: Industrical Fuel Fired Furnaces]

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SPECIFICATION FOR MOULD AND CORE SAND DRYERS, ROTARY TYPE

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SPECIFICATION FOR MOULD AND CORE SAND DRYERS, ROTARY TYPE

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AMENDMENT NO. 1 JULY 2011
TO
IS 11462 : 1985 SPECIFICATION FOR MOULD AND CORE SAND DRYERS, ROTARY TYPE

[*Page* 4, *clause* **1.1**(c)] — Delete.

(*Page* 5, *clause* **3.8**) — Substitute the following for the existing:

'The drive system shall comprise a friction drive through rollers and tier. Rollers are made of EN-9 steel and Tier is made of mild steel. One or two of the supporting roller is/are made live driven through motor and gear box and rotates the shell by friction through supporting ring tier. The speed depends on size of rotary dryer.'

(*Page* 6, *clause* **3.9**) — Delete.

(*Page* 7, *clause* **6.1**, *line* 5) — Delete the words 'and not less than 500°C'.

(*Page* 7, *clause* 6.4) — Substitute the following for the existing:

'The atomizing air pressure shall depend on the burner design type and fuel to be used.'

[*Page* 7, *clause* 7.1(i)] — Substitute the following for the existing:

Fuel oil like heavy furnace oil, light diesel oil, high speed diesel and LSHS fuel	9 500 kcal/kg to 10 500 kcal/kg	0.78 to 0.96 (for liquid with respect to water = 1). Specific gravity with respect to water also varies for different fuel oil.

[*Page* 8, *clause* 7.1(iii)] — Delete and renumber the other columns.

[*Page* 8, *clause* **7.1**(iv)]:

a) Delete the words '(Baroda gas)' from the first column.
b) Substitute the following for existing in the second column:
'8 000 – 9 000 kcal/Nm^3'.
c) Delete the words '(with respect to air =1)' from the third column.

(*Page* 9, *clause* 8.1.3, *Heading*) — Substitute '*Safety of Fuel Combustion*' *for* '*Control of Fuel Combustion*'.

[*Page* 10, *clause* **8.1.3**(e)] **—** Add the following at the end:

f) **Gas Train Equipment —** Gas Train Equipment as safety device shall consist of the following:

- — Manual shut-off valve
- — Gas filter
- — Gas governor
- — Safety shut-off valve
- — Low gas pressure switch
- — High gas pressure switch
- — Pressure gauge with 2-way cock

(*Page* 10, *clause* **8.1.4**) **—** Add the following as new clause **8.1.4** and renumber the existing clause **8.1.4** as **8.1.4.1**:

'**8.1.4** *Temperature Control System* — The dryer can be supplied with or without automatic temperature controlling system, which if required will consist of following:

- Thermocouple to be located in the oven
- Temperature Controller
- Combustion Air Control Valve with Actuator
- Fuel/Air Ratio Regulator

(*Page* 11, *clause* **9.2) —** Add the following at the end:

'In case of certain types fuel air burners, atomizing air pressure may be higher, say 1 300 to 1 500 mmWG and 5 to 6 bar in case of atomization with compressed air.'

(MTD 26)

Reprography Unit, BIS, New Delhi, India

Indian Standard

SPECIFICATION FOR MOULD AND CORE SAND DRYERS, ROTARY TYPE

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 24 September 1985, after the draft finalized by the Industrial Fuel-Fired Furnaces Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 Sand dryers used in Indian industry are of many types. This standard is limited to the rotary sand driers operating at approximately atmospheric pressure and maximum temperature of 500°C, for drying washed and graded silica sand.

0.3 The silica sand shall contain:

a) a minimum of 98 percent silica,

b) not more than 10 percent moisture at the time of its feed to the dryer, and

c) not more than 0·4 percent clay.

0.4 The wet sand shall flow uniformly through a heat resisting alloy chute into the dryer at the rated input per hour in kg and parallel or counter current to the flow of hot gases and also in direct contact with them.

0.5 All the physical tests for foundry sands shall be conducted according to the methods laid down in IS : 1918-1966*.

0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960†. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

---

*Methods of physical tests for foundry sands.

†Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard applies to newly manufactured sand dryers of rotary type, for foundries, using any of the following fuels:

a) Fuel oil,

b) Liquefied petroleum gases (LPG),

c) LPG-air mixture,

d) Natural gas, and

e) Coke oven or producer gas.

2. LOCATION

2.1 Ovens shall be located and erected so that the building structural members shall not be adversely affected by the maximum anticipated temperatures.

2.2 Ovens shall be well separated from valuable stock, important power equipment, machinery and sprinkler risers, thereby securing a minimum interruption to production and protection in case of accidents to the ovens.

2.3 Ovens shall be safely located and protected from exposure to dip tanks, spray booths, storage and mixing room, flammable liquids or exposure from or to the diffusion of flammable air-vapour mixtures.

2.4 Ovens shall be readily accessible with adequate space above them to permit installation of automatic sprinklers, proper use of house streams, the proper functioning of explosion vents, inspection and maintenance.

2.5 Combustible roofs and floors of ovens shall be ventilated to keep temperature below 71°C or they shall be well insulated.

2.6 The external temperature of the floor near the ovens shall not exceed 121°C when supporting floor is of concrete, steel channels or tiles. Adequate insulation therefore should be further provided, equivalent to the insulating value used for the oven walls and roof, bearing in mind the need of protection against mechanical damage or abrasion.

2.7 When oven ducts or stacks pass through combustible walls, floors or roofs, adequate insulation and clearances shall be provided so that the combustible materials do not achieve the temperatures exceeding 71°C.

3. MATERIALS OF CONSTRUCTION AND OTHER CONSTRUCTION DETAILS

3.1 The construction of all parts whether specifically covered by this standard or not shall be in accordance with reasonable concepts of safety and durability. The equipment and its construction shall provide at least a performance level equivalent to that covered in this standard.

3.2 The brief exposure of the rotating dryer shell to high temperature gases, in the first section immediately after the chute shall determine the shell thickness, the pitch, height of the flights, which transport the wet sand through this section.

3.3 The front end of the dryer which is connected to the chute from the static hot gas mixing duct shall be satisfactorily sealed against in-rush of unnecessary cold air, which is detrimental to the thermal efficiency of the dryer. If at all this clearance is used to supply fresh excess air, the corresponding reduction shall be done in the excess air quantity supplied at the burner end.

3.4 The front end and the rear end of the dryer shall be located in reference to the dryer length in such a way as to allow the expansion of the dryer lengthwise, on both the ends, as uniformly as possible, depending on the ambient temperature and the inlet and outlet operating temperature.

3.5 Given equality of surface area and surface condition, the continuous heat exchange between the hot gas and the wet sand in a rotary dryer depends on the log mean temperature difference and the heat transfer area, which in turn depends on the efficiency of the quadrant distribution (baffles), that is, sub-division of the cross-section area of rotary drum. This arrangement shall be rugged, simple, dismantable and shall have a construction to compensate for the thermal stresses, *in situ* besides high efficiency for heat transfer area.

3.6 The mountings of the dryers shall be of a good design, precision, workmanship, ensuring maximum dependability under heavy rotating load, thermal expansion both radial and axial.

3.7 The bearings of the antifriction type and the guide roller supports shall be adjustable on the mounting, which in turn shall be grouted firmly, in R.C.C. plinth. Rim rollers and guide rollers shall be of high grade cast steel with roller surfaces hardened.

3.8 The drive system shall comprise a spur toothed gear and pinion of high strength cast steel, with accurately cast teeth made of chilled cast iron. The speed is 4-6 rev/min approximately.

3.9 The pinon shall be driven by a shaft, flexible coupling, helical gear box and slip ring induction motor, with a minimum of 200 percent full load torque, and with a complete safety guard.

3.10 Knockers shall be used only if required to prevent the sticking of wet sand on the wall of the dryer, near the chute.

4. DUCT

4.1 All exposed hot fan casings, cyclones and hot ducts within 2 metres of the building floor shall be protected to prevent injury to personnel.

4.2 Exhaust ducts shall not discharge near the doors nor the windows or the other air intakes, in a manner that shall permit re-entry of the exhaust into the building.

4.3 Exhaust ducts containing fines of sand shall not be allowed to discharge over the roof. Instead these should discharge into an efficient dry cyclone system or with filter fabric or wet cyclones.

4.4 The surface temperature of all ducts, their bracings, brackets and hangers should not exceed 71°C and these should be adequately protected with mineral wool insulation.

4.5 Ducts shall be constructed entirely of sheet steel or other non-combustible material of adequate strength and rigidity, to meet the service conditions. The ducts of sheet steel shall be constructed of hot rolled sheet of thickness not less than 1·6 mm.

4.6 Ducts shall have adequate facilities for access so as to permit proper inspection and maintenance.

5. CHUTES

5.1 The chute, through which the wet sand shall flow at the rated capacity, shall be subjected to hot gas temperatures not exceeding 700°C. Thus it shall be designed with reasonable concepts of durability, substantiality and safety. For temperatures up to 400°C, 10 mm thick mild steel plates shall be used for the construction of the chute. For temperatures above 400°C, suitable grade and thickness of alloy steel plates, as agreed to between the manufacturer and the purchaser, shall be used.

6. DRYER — HEATER SYSTEM

6.1 It shall be a heating system, in which the burners burn the fuel, with not more than 10 percent excess air, and produce the products of complete combustion. These shall be then mixed with fresh air effectively in a mixing duct, to produce hot gases at a temperature not more than 700°C and not less than 500°C, for the parallel and counter current flow rotary dryers.

6.2 The quenching and tempering of the above products of combustion from their flame temperature, to the desired temperature of the hot gases, in the mixing duct shall be efficient and thorough and shall be such that there shall not be a direct flame impingement on the inlet chute of the dryer.

6.3 The combustion chamber shall be designed for safety, the rated intensity of heat in kcal/h.m^3, the flame lengths and the number of flames (burners).

6.4 The atomising air pressure may be 1 000 mm of water (gauge) or 0·7-2·1 kgf/cm^2 but shall depend on the burner size and desired turn-down.

6.5 Excess air-fuel burners, which may produce hot gases up to 500°C may be an alternative to the above burner.

6.6 An explosive vent shall be provided on the top of the combustion chamber or mixer duct in such a way that the operators shall not be exposed to any danger or injury. The venting ratio of 1 : 9 for example, one square metre for every 9 m^3 of the combustion chamber inclusive of the mixer unit, shall be provided.

6.7 A cyclone fan of adequate capacity with respect to temperature, pressure drop and air delivery shall be installed on the discharge side of the rotary dryer, in such a way that the hot dried sand shall fall through a discharge chute vertically downwards, while the hot gases at about 125 to 170°C are sucked up by the unit through a set of cyclones.

7. CHARACTERISTICS OF FUELS

7.1 In conducting the performance tests, fuels having characteristics as shown below shall be used:

Fuel	*Heating Value**	*Sp Gr at 15°C*
i) Fuel oil	10 000 kcal/kg	0·546 (for liquid with respect to water = 1)
ii) Liquefied petroleum gas (LPG)	11 800 kcal/m^3	1·830 (for gas with respect to air = 1)

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*The heating value refers to 15°C, 760 mm mercury pressure and dry gas.

Fuel	*Heating Value**	*Sp Gr at* 15°C
iii) LPG-air mixture	12 670 kcal/m^3	1·42 (with respect to air = 1)
iv) Natural gas (Baroda gas)	11 900 kcal/m^3	0·778 (with respect to air = 1)
v) Coke oven gas	4 200 kcal/m^3	0·45 (with respect to air = 1)
vi) Producer gas	1 300 kcal/m^3	0·90 (with respect to air = 1)

8. FUEL SAFETY CONTROL (*see* Fig. 1)

8.1 Fuel safety control covers appliances, such as safety shut-off valve, flame detection unit, time-delay relays (TDR), pressure switches—high and low, supervisory cocks, solenoid valves, etc. These devices shall be used to provide:

a) sufficient pre-ventilation,

b) sufficient ventilation during operation,

c) control of fuel combustion, and

d) over temperature protection.

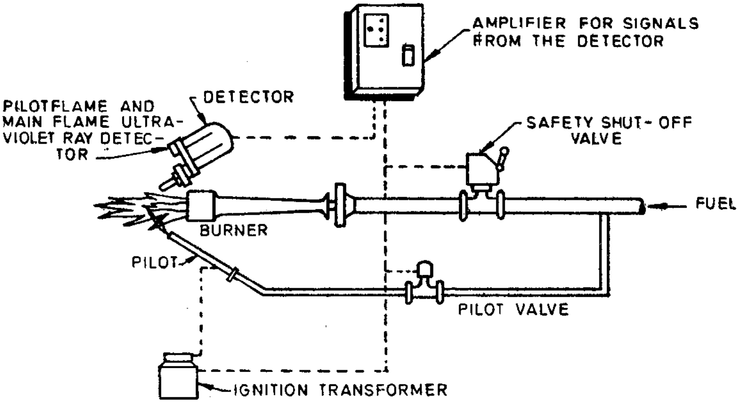
AMPLIFIER FOR SIGNALS FROM THE DETECTOR
DETECTOR
PILOTFLAME AND MAIN FLAME ULTRA-VIOLET RAY DETECTOR
SAFETY SHUT-OFF VALVE
FUEL
BURNER
PILOT
PILOT VALVE
IGNITION TRANSFORMER

Fig. 1 Fuel Safety Control

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*The heating value refers to 15°C, 760 mm mercury pressure and dry gas.

8.1.1 *Pre-ventilation or Purging*

a) Timed pre-ventilation is essential for all ovens in which the fuel may accumulate during a shut down period or after an accidental flame failure;

b) For oven volumes less than 10 m^3, the operation of purging may be omitted if the doors are to be opened for turning on the heat again;

c) In all other ovens of volume more than 10 m^3 all doors, manholes and explosion vents shall be opened in such a way that the total vent area is 1 m^2, for every 4·5 m^3 of the oven;

d) An approved time delay relay shall be arranged in the safety control circuit and set so as to require the operation of exhaust and re-circulating fans for a sufficient time to provide 4 (four) oven volume changes of FRESH AIR, before the fuel is turned on or the conveyor is operated. An audible and visible alarm shall operate during the purge;

e) Combustion blower shall be interlocked so that it may not be started, until the purge is completed; and

f) Automatic recycling after accidental flame failure is not allowed.

8.1.2 *Ventilation*

a) Exhaust duct pockets shall be located in the area of greatest concentration of fumes and pockets of static gases;

b) All exhausts shall be equipped by mechanical ventilators using power driven fans. Each oven shall be equipped with its own individual exhaust fan and not a common system, serving other ovens or equipment; and

c) A clear space of at least 1 to 2 metres shall be made available on the rear side of the burner as a safety operational requirement.

8.1.3 *Control of Fuel Combustion* — To control the fuel combustion the following protective devices may be provided:

a) *Safety shut-off valve* — The primary safety shut-off valve used in the main fuel supply line shall be of manually opening, automatically closing type. This valve shall be properly interlocked to shut down upon any abnormal operating conditions or failure of safety control circuit. A leak test facility shall be provided downstream of fuel supply shut-off valve.

b) *Flame detection device* — It detects the presence or absence of flame and shall automatically shut-off the fuel supply in the event of flame outage. The flame detection equipment shall have safe start check and 2 to 4 seconds flame failure response time. The flame detector shall be interlocked to shut down individual burners, separate zones, or the entire oven at the option of the manufacturer.

c) *Pressure switch* — A pressure activated device is arranged to effect a safety shutdown of the burner or burners from starting in the event of a malfunction with respect to the pressure of the fuel or combustion air. Both automatic and manual reset type pressure switches are acceptable. They shall be interlocked with a safety shut-off valve to stop the fuel flow when abnormal fuel pressure or combustion air pressure occur. The abnormal pressure may be higher or lower than specified for safe and correct operation of burner zones or entire oven.

d) *Safety blow device* — It is a device provided near the outlet of each gas mixing machine, where the nominal size of piping is larger than 65 mm to protect the machine in the event of air explosion through an automatic fire check, covering a flame arrester, a blow out disk, provision of automatic shutting of the supply of air gas mixture.

e) *Ignition system* — Ovens, when operating below 760°C shall have burner ignition by spark ignited interrupted pilots, torch or by direct spark ignited self piloted burners. The burners shall produce stable flame during the trial-for-ignition period. When pilots, or main burners are spark-ignited, the spark shall be shut-off at the end of the trial-for-ignition period.

8.1.4 *Excess Temperature Controller* — It shall be provided and suitably interlocked with the safety control circuit so that all the main burners controlled by the circuit shall be shut-off in the event of excess temperatures. It shall not automatically re-open the fuel valve. This control shall be in addition to any normal temperature control devices used.

8.2 To ensure further the closure of all individual main burners, cocks, before the main burner shut-off valve may be opened, the fuel safety control system shall also guarantee the following interlock operations:

a) combustion air pressure is normal,

b) atomizing medium pressure is normal,

c) normal gas pressure in the pilot is normal,

d) ventilation fan is operating,

e) pre-ventilation purge is completed, and

f) the combustion safeguard of the pilot opens its safety solenoid/ shut-off valve.

8.3 Typical arrangement for fuel safety control for gas fired and oil fired heating systems is shown in Fig. 2 and Fig. 3, respectively.

9. FUEL OIL AND FUEL GAS BURNERS

9.1 The main burner system shall operate on high-low flame. For oil burners one of the following alternatives shall be adopted:

a) *Self Proportioning Low-air Pressure Oil Burner with Single Lever Air Oil Control* — The control lever may be operated manually or by a reversible modualating servo-motor or a pneumatic cylinder. The single lever operation shall permit automatic proportioning of air-oil ratio, based on the feed back received from the temperature control instrument.

b) *Low Air-pressure Oil Burner* — It may have external ratio regulator for proportioning air-oil ratio. The regulator may be used for individual burners, or zones or entire oven and cross-connected to combustion air line downstream of air control valve. The change in pressure across the valve is the pressure impulse on the diaphragm of the regulator. The oil flow is thereby regulated automatically in proportion with air flow. The oil pressure before the ratio regulator shall be 1·5-2·0 kgf/cm^2. The air control valve may be operated manually or by servo motor by the feed back received from the temperature control instrument. These burners shall have separate inlet ports for atomizing and combustion air.

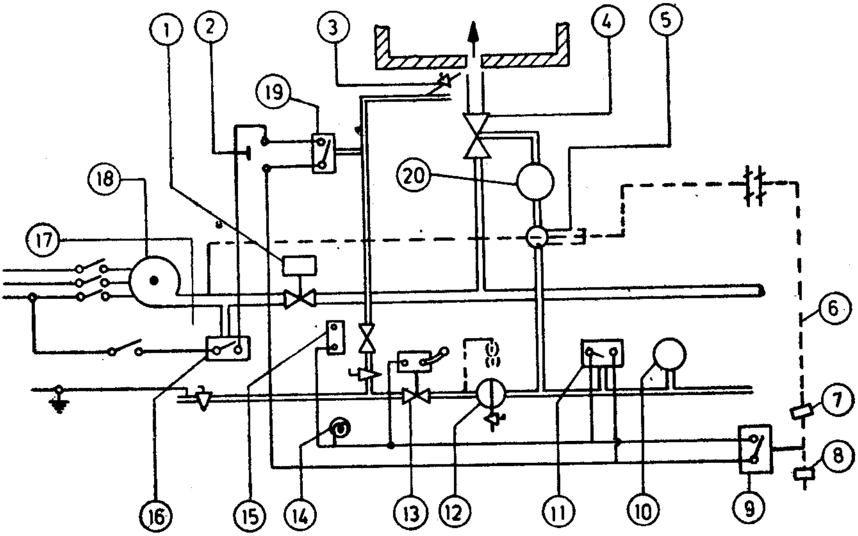
9.2 The combustion and atomizing air pressure shall be specified by the burner manufacturer but the atomizing air pressure shall be not less than 620 mm WG for light distillate oils and 970 mm WG for heavy oil. Excess air burners with high flame stability are desirable for low temperature ovens. These burners shall also be capable of firing on ratio.

9.3 Gas burners shall be essentially nozzle mix type. Air-gas regulator shall be used for proportioning gas with regard to air by cross connecting the regulator to the main air line down stream of the air control valve. Burners shall have high degree of stability under excess air conditions.

10. CYCLONE FAN/CYCLONE SYSTEM

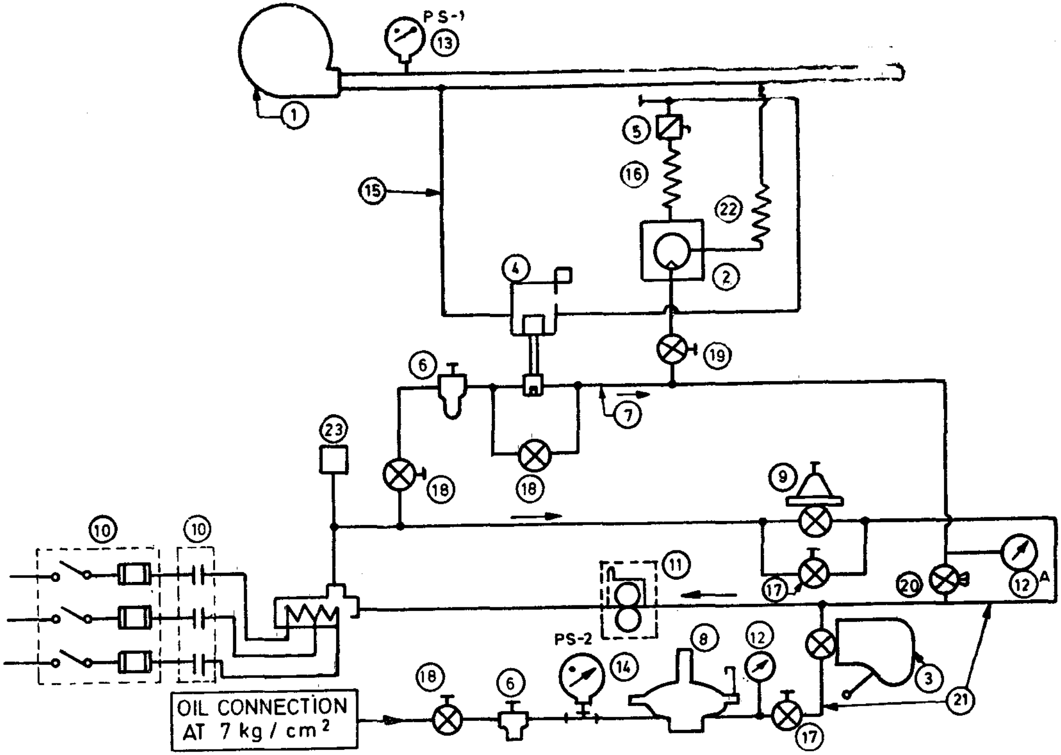
10.1 The dryer design shall be such that the velocity of hot gases across the dryer is in the range of 7 500-10 000 metres/hour, at 170°C, *Max.* The fan specification shall then depend on the dryer shell diameter, the temperature of the gases at the inlet and the outlet and the pressure drop across the baffles, through the axis of the dryer.

10.2 The cyclone fan shall be connected to a set of efficient cyclones for fine dust collection.



1. Temperature control
2. Push button near pilot cock
3. Pilot
4. Inspirator
5. Handle
6. ϕ 6 O. D. copper tubing
7. Filter
8. Bleed orifice (1/32 size)
9. Checking pressure switch
10. Zero governor for several inspirator
11. Low gas-pressure switch
12. Supervising (F M) cock for leakage test of safety shut-off valve
13. Main safety shut-off valve, manual reset
14. Light
15. Pilot solenoid valve
16. Low air-pressure switch
17. Main furnace blast gate for air
18. Combustion air blower
19. Pilot gas-pressure switch
20. Zero governor

FIG. 2 SAFETY CONTROL FOR GAS FIXED HEATING SYSTEM



1. Combustion air blower at 0·14 kgf/cm^2
2. Oil burner
3. Safety shut-off valve
4. Air-oil ratio regulator (ratiotrol)
5. Butterfly valve for air
6. Oil filter
7. Proportioned and metered oil supply line
8. Oil shut-off valve — pneumatic
9. Diaphragm relief valve
10. Oil heater and its electrics
11. Oil pump
12. Oil pressure gauge
13. Normally open pressure switch for air
14. Normally open pressure switch for oil
15. Supply of secondary air
16. Flexible air pipe for secondary air
17. Globe valve for oil
18. Globe valve for oil
19. Globe valve for oil
20. Needle or sensitrol valve
21. Return oil pipe line
22. Flexible air pipe for primary air
23. Oil heater expansion chamber

FIG. 3 SAFETY CONTROL FOR OIL FIRED HEATING SYSTEM